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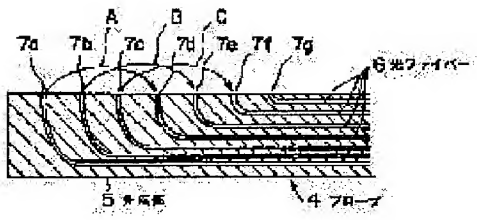
(54) **MEASURING DEVICE FOR METABOLISM INFORMATION**



(57)Abstract:
PURPOSE: To provide a metabolism information measuring device which can measure accurately and distributively the metabolism information of a living body tissue.
CONSTITUTION: Plural light emitting and receiving windows 7a-7f are provided along the axial direction of a tip portion 5 at a side surface of the tip portion 5 of a probe 4, and functions to emit inspection light that measures the metabolism information of a living body tissue, to the tissue and at the same time to receive inspection light that has transmitted the inside of the tissue, at light emitting and receiving windows 7a-7f, are provided. When the tip portion 5 of the probe 4 inserted into the body cavity of the living body is pressed against the tissue and inspection light is emitted in order through plural light emitting and receiving windows 7a-7f, inspection light transmits the tissue while conducting scattering and reflecting, and is received at light receiving portions opposite to light emitting and receiving windows 7a-7f. By repeating this, the metabolism information of the tissue is measured distributively.

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3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]An inspection light emitting means which emits inspection light which measures metabolic turnover information of an organization to a body tissue.
A light-receiving means to receive inspection light which penetrated said in-house.
It is the metabolic turnover information measuring device provided with the above, and at least two or more one side has been arranged along shaft orientations of a probe among said inspection light emitting part or an inspection light light sensing portion.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the metabolic turnover information measuring device of a body tissue suitable for measuring biological information, body tissues, such as the heart and a brain, the saturation of oxygen in an organ, i.e., an oxygen metabolic turnover etc., etc., using light.
[0002]
[Description of the Prior Art]The light of a near infrared region has from red the features, such as light absorption to the substance which manages the oxygen metabolic turnover of living bodies, such as the high permeability and hemoglobin to a body tissue, myoglobin, and a cytochrome oxidase, and change of the extinction spectrum corresponding to the oxygen bond information.
[0003]Using such a feature, the method of measuring the oxygen metabolic turnover of various organs, such as the heart in the living body and a brain, is known as shown in USP4223680 and USP4281645. This irradiates an organ in the living body and organization with the light of a 700-1300-nm near infrared region, and the catoptric light reflected from said organ and the organization depths or the penetrated light is

detected, Blood volume, hemoglobin, and the degree of oxygenation of a cytochrome are measured by carrying out the comparison operation of the light intensity between wavelength.

[0004]The chromoprotein which has here copper which exists in the mitochondrion of a cell with said cytochrome (oxidation type Cu2+ reduction type Cu+). Usually, although 80% is an oxidation type, at an early stage comes a reduction type at the time of the ischemia. For this reason, the redox status of a cytochrome can be measured from the absorbed amount of each wavelength, and it is used as an index of the oxygen metabolic turnover of an organization.

[0005]When the worst [myocardial infarction occurs, and], it results in a necrosis of a myocardium, but in an early stage or an acute case, activity of a myocardium has stopped, but it may not result in a necrosis. In such a case, PTCA and a bypass are effective. Although diagnosis of whether the myocardium is valid until now using PET or it is dead was performed and implementation of the bypass operation was judged, the PET device is very expensive and has seldom spread.

[0006]When measuring the cardiac muscle tissue, it is diagnosing by carrying out a prescribed period blockade by the balloon etc. which have been arranged beforehand at coronary arteries, and measuring metabolic turnover change of a myocardium, pressing the tip part 2 of the scope 1 against the cardiac muscle tissue 3, as a scope is inserted from a membrum-inferius main artery and it is actually shown in drawing 20. Since there is no metabolic turnover change at this time when the myocardium is dead, it can be diagnosed whether the myocardium is valid or it is dead.

[0007]By the way, JP,59-230533,A known as a conventional metabolic turnover information measuring device, The light from a light source was floodlighted to the body tissue through the fiber for floodlighting, the catoptric light from a body tissue was transmitted to the light sensing portion using two or more optical fiber bundles, after carrying out a spectrum with a different wavelength filter provided in the end face, respectively, the strength of catoptric light was measured according to each wavelength, and the information on the target body tissue is measured.

[0008]JP,61-11614,B floodlights intermittently by turns the near infrared region containing the light of the various wavelength in a 700-1300-nm spectral range to a body tissue in a predetermined cycle, The catoptric light from a body tissue was received by the light sensing portion, the strength of catoptric light was measured according to each wavelength, and the information on the target body tissue is measured.

[0009]

[Problem(s) to be Solved by the Invention]By the way, in both patents of USP4223680 and USP4281645, it is being emphasized that the course of the light must be comparatively long by the case where an applicant measures an oxygen metabolic turnover using the light of a near infrared region. That is, it is because carrying out as a long course is straddled can include the metabolic turnover information on the depths to

the target organization.

[0010]When irradiating with and detecting light for the metabolic turnover of an organ from one way (this is called a reflective method), in order to attain said purpose, the irradiation part and primary detecting element of light say that they need to detach about several centimeters, respectively. In "surveillance of brain oxygen metabolic turnover at time of the foreign circulation using near-infrared somatometry method" population organ 19(1)535-538 (1990), in order to measure the oxygen metabolic turnover within a brain, the irradiation part and the primary detecting element are detached 3-4 cm.

[0011]The endoscope which can observe the inside of a blood vessel by a picture is used with medicine at large not to mention the stomach and the large intestine in recent years using the optical fiber bundle. This endoscope has the feature which it can be exact and can be performed at an early stage for diagnosis of a disease by carrying out direct observation of the organ which is not visible from foreign out of the abdominal cavity.

[0012]A hole called a channel is provided in the endoscope and it is used for diagnosis, a therapy, etc. of a lesion part which can insert treatment implements, such as a bioptome and electrotome, in the inside of the body through a channel from foreign, and are not known in diagnosis by a picture.

[0013]These days, examination which inserts the optical fiber probe for measuring the saturation of oxygen using this channel, diagnoses the metabolic turnover information on a lesion part, or inserts an optical probe directly under radioscopy, and asks for the oxygen metabolic turnover of an organ is performed.

[0014]About said optical probe, it is detailed to a "medical use catoptric light spectral analysis apparatus using optical fiber probe" medical use electron, bionics Vol.28No3 (1990), and JP,59-230533,A.

[0015]The outer diameter of the insert portion of the probe is thin, and so that the above optical fiber probes can be inserted into the abdominal cavity By the way, the sake, Since the irradiation part which irradiates with light, and the primary detecting element which detects approach extremely, and is stationed and the pulsed light of time width long enough is used compared with the velocity of light, light detects the light which did not straddle a comparatively long course but passed through the organization chart side. That is, such a method measures metabolic turnover information only within the surface of an organization, it was strongly influenced by the body fluid and blood which were attached to the epidermis and outside skin of the organization, and the metabolic turnover information on the organization depths was not able to measure it.

[0016]This invention was made paying attention to said situation, and there is a place made into that purpose in providing the metabolic turnover information measuring device which can measure the metabolic turnover information on a body tissue correctly in distribution.

[0017]

[Means for Solving the Problem]In what has an inspection light emitting means which emits inspection light which measures metabolic turnover information of an organization to a body tissue in order that this invention may attain said purpose, and a light-receiving means to receive inspection light which penetrated said in-house, It is in having arranged at least two or more one side along shaft orientations of a probe among said inspection light emitting part or an inspection light light sensing portion.
[0018]
[Function]If the tip part of the probe inserted into a living body's abdominal cavity is pressed against the body tissue as an inspected part and inspection light is emitted one by one from two or more inspection light emitting parts, inspection light will be penetrated being scattered about and reflecting a body tissue, and will be received by the inspection light light sensing portion corresponding to said inspection light emitting part. The metabolic turnover information on a body tissue is measured in distribution by repeating this.
[0019]
[Example]Hereafter, each example of this invention is described based on a drawing.
[0020]Drawing 1 - drawing 4 are the 1st example, and drawing 1 shows the tip part 5 of the probe 4 for metabolic turnover information detection. The inner package of two or more optical fibers 6 is carried out to the probe 4, two or more transmission-and-reception optical windows 7a-7g are arranged along the shaft orientations of an insert portion at regular intervals in the side of the tip part 5, and the apical surface of each of said optical fiber 6 is connected to each transmission-and-reception optical windows 7a-7g.
[0021]The end piece of each of said optical fiber 6 has countered the laser diode 9 as a light source, and the photo detector 10 as a detector via the half mirror 8, as shown in drawing 3. Therefore, if light is emitted in the pulsed light of predetermined wavelength from the laser diode 9, With the optical fiber 6, the light guide of the catoptric light which was reflected by the half mirror 8, and the light guide was carried out to the transmission-and-reception optical windows 7a-7g with the optical fiber 6, and was received from the transmission-and-reception optical windows 7a-7g is carried out, it penetrates the half mirror 8, and is received by the photo detector 10.
[0022]Therefore, two or more transmission-and-reception optical windows 7a-7g arranged at said tip part 5 are an object for an exposure, and common use for light-receiving. The optical fiber 6 linked to the three transmission-and-reception optical windows 7a, 7b, and 7c by the side of a tip and this is made an exposure here, When the transmission-and-reception optical windows 7d, 7e, and 7f are made light-receiving, the light A irradiated from the transmission-and-reception optical window 7a is received by 7 d of transmission-and-reception optical windows, the light B irradiated from the transmission-and-reception optical window 7b is received by the transmission-and-reception optical window 7e, and the light C irradiated from the

transmission-and-reception optical window 7c is similarly received by 7 f of transmission-and-reception optical windows.

[0023]And where it inserted the probe 4 into the living body cavity and the tip part 5 of the probe 4 is pressed against a body tissue, If it irradiates with pulsed light one by one from the transmission-and-reception optical windows 7a, 7b, and 7c as shown in drawing 2, the light A irradiated from the transmission-and-reception optical window 7a will advance diffusing the inside of a body tissue, and the catoptric light which passed the depths of the body tissue will be received by 7 d of transmission-and-reception optical windows. Similarly the light B irradiated from the transmission-and-reception optical window 7b is received by the transmission-and-reception optical window 7e, and the light C irradiated from the transmission-and-reception optical window 7c is received by 7 f of transmission-and-reception optical windows.

[0024]Said pulsed light is a near infrared (700 nm - 950 nm) with which this wavelength has absorption in a cytochrome and hemoglobin including oxygen metabolic turnover information, for example.

Being able to catch effectively the catoptric light which passed the depths of the body tissue, this catoptric light asks for the saturation of oxygen of hemoglobin, myoglobin, and a cytochrome by the photo detector's 10 detecting and calculating the detection light of each wavelength.

[0025]And by scanning in order of the light A, B, and C, as shown in drawing 4, metabolic turnover distribution of field I with few metabolic turnover activities and field RO with many metabolic turnover activities is acquired, and not only a part but a large field can be measured for the metabolism condition of a body tissue at once.

[0026]Drawing 5 is the 2nd example. this example -- the tip part 5 of the probe 4 -- the one transmission-and-reception optical window 7a by the side of a tip is most made an exposure, and two or more remaining transmission-and-reception optical windows 7b and 7c-- are made light-receiving. According to this example, by changing the transmission-and-reception optical window 7b as an object for light-receiving, and 7c-- one by one, the interval of an irradiation part and a light sensing portion can be changed, and the metabolism condition from the shallow portion of a body tissue to a deep portion can be measured in distribution.

[0027]Drawing 6 is the 3rd example. This example forms two or more transmission-and-reception optical windows 7a and 7b and 7c-- in the tip part 5 of the probe 4 at ring shape. By according to this example, making an exposure most the one transmission-and-reception optical window 7a by the side of a tip, for example, and making light-receiving two or more remaining transmission-and-reception optical windows 7b and 7c--, While being able to change the interval of an irradiation part and a light sensing portion and being able to measure the metabolism condition from the shallow portion of a body tissue to a deep portion in distribution by changing the transmission-and-reception optical window 7b as an object for light-receiving, and 7c--

one by one like the 2nd example, When measuring a living body's lumen etc., the perimeter can be measured by one measurement.

[0028]Although the probe 4 was inserted into the abdominal cavity and the case where it measured in the state and the state where it got blocked and fixed which pressed the tip part 5 against the body tissue was explained in said each example, By forming an angle-of-rotation detection means in the base end of the probe 4, and rotating the probe 4 within the abdominal cavity, it can display in three dimensions or the metabolic turnover activities in the section of a right-angled field can also be displayed on the axis of the probe 4.

[0029]It is ****** to assumption of reflecting many metabolism conditions on the curve which connects an exposure and a light-receiving position probable when each exposure and the optical fiber 6 for light-receiving are exposed right-angled to the surface of the probe 4, respectively by the physical relationship of said exposure and light-receiving. Therefore, when there is a different large organization of a bone with much reflection on this curve, an air object, or a refractive index, for example, a diagnostic result is not obtained correctly. However, within the lumen in a uniform organ, the result of having reflected the metabolic activity situation mostly is obtained, and the information about the life and death of an organization is acquired.

[0030]Drawing 7 shows the entire configuration of a metabolic turnover information measuring device, and 11 is a light source which consists of four laser diodes which are not illustrated. 12 is the extension which can be inserted in the heart in the abdominal cavity, the stomach, the large intestine, a brain, etc., and is a probe which consists of a narrow diameter flexible tube.

[0031]13 is a reference beam detector which measures the light intensity irradiated by the body tissue, 14 is a detector which measures the light resulted and reflected in the body tissue depths, and further 15 is a control device which controls said light source 11 and asks for a metabolic turnover from the signal of the reference beam detector 13 and the detector 14 synchronizing with it.

[0032]Said probe 12 is what covered the optical fiber bundle which consists of six bundles which are not illustrated with the flexible tube, It has the final controlling element 20 with the angle final controlling element 19 for carrying out curving operation of the insert portion 16 inserted into the abdominal cavity, the bend 18 established in the tip part 17 of the insert portion 16, and this bend 18.

[0033]Two or more fibers 22a for optical transmissions which the universal cord 21 is connected to said final controlling element 20, and are connected with said light source 11 via the connector 22 at this universal cord 21, The inner package of the fiber 27 for light-receiving connected with the fiber 25 for reference beam detection and the detector 14 which are connected with the reference beam detector 13 via the connector 24 via the connector 26 is carried out.

[0034]It was connected to the fiber 23 for an exposure, and said two or more fibers 22a

for optical transmissions have extended this fiber 23 for an exposure, and the fiber 27 for light-receiving to the tip part 17 through the insert portion 16 of the probe 12. And if one of them is explained, as shown in drawing 8, it is joined to the prism 28 and 29 formed in rectangular directions to the shaft orientations by the tip part 17, and the emitting end 23a of said fiber 23 for an exposure and the incidence edge 27a of the fiber 27 for light-receiving are optically connected to it.

[0035]Therefore, the optic axis of said fiber 23 for an exposure and the fiber 27 for light-receiving is changed by the prism 28 and 29 right-angled to the longitudinal direction of the tip part 17. Reflection films, such as aluminum for reflecting light in the reflectors 28a and 29a of both the prism 28 and 29 efficiently, are vapor-deposited.

[0036]Drawing 9 is the structure projected more slightly than the side while it curves the tip part of said fiber 23 for an exposure, and the fiber 27 for light-receiving right-angled in the tip part 17 of the insert portion 16 instead of said prism 28 and 29 and turns the emitting end 23a and the incidence edge 27a to the side of the tip part 17. The protecting part 17a from which the projection part of said emitting end 23a and the incidence edge 27a protects the invasion to me or a body tissue is formed.

[0037]The bending angle of said fiber 23 for an exposure and the fiber 27 for light-receiving may be set as a bending angle which spreads as it does not need to be right-angled and the optic axis of the light detected in the optic axis and the incidence edge 27a of light which were emitted from said emitting end 23a separates from the tip part 17. Next, an operation of the metabolic turnover information measuring device constituted as mentioned above is explained.

[0038]First, the pulsed light of four different wavelength is generated one by one with the light source 11. For example, this wavelength is a cytochrome including oxygen metabolic turnover information and a near infrared (700 nm - 950 nm) which has absorption in hemoglobin. It is connected to the connector 22 and the light guide of such lights is carried out to the fiber 23 for an exposure which build and is, respectively.

[0039]The light guide of the light by which the light guide was carried out to the fiber 23 for an exposure is carried out to the tip part 17 of the probe 11, and it is uniformly irradiated by the body tissue 30 via the prism 28 from the emitting end 23a. Here, since it is connected also with the reference beam detector 14 via the fiber 25 for reference beam detection, the fiber 23 for an exposure can measure, catoptric light, i.e., irradiation light intensity, immediately after the body tissue 30 glared.

[0040]The light irradiated by the body tissue 30 advances for the light scattering by an organization, diffusing the inside of the body tissue 30. And a part of this light, i.e., catoptric light, enters into the incidence edge 27a of the fiber 27 for light-receiving from said prism 28 and the prism 29 which separated about 5 mm - several centimeters, and a light guide is carried out to the detector 14 via the fiber 27 for light-receiving.

[0041]Therefore, by being able to catch effectively the catoptric light which passed the depths of the body tissue 30, detecting the light of wavelength different, respectively

one by one, and calculating the reference beam wavelength and detection light of each wavelength mutually, In quest of the saturation of oxygen of hemoglobin, myoglobin, and a cytochrome, it displays on an indicator (not shown).

[0042]For example, when measuring the metabolic turnover of a myocardium, said insert portion 16 is inserted from a femoral artery under radioscopy, and the flank of the tip part 17 is pressed against the myocardium of the left ventricle through a main artery. The angle final controlling element 19 is operated and the bend 18 is curved so that the tip part 17 may hit the body tissue 30, and it is made for the prism 28 and 29 and the body tissue 30 which were provided in the tip part 17 to contact without a crevice at this time.

[0043]The metabolic turnover of a stomach wall may be measured, using the channel of the endoscope inserted not only in the metabolic turnover of a myocardium but in the stomach, and observing under an endoscope, or from a cerebral blood vessel, the probe 12 may be inserted and metabolic turnovers, such as the pancreas, ****, and liver, may be measured.

[0044]Drawing 10 - drawing 12 are what equipped the tip part 32 of the insert portion 31 of a probe with the sucking function, 33 is a window of source container and 34 is a sensor window. The suction hole 35 is established in the both sides of the window of source container 33 and the sensor window 34. This suction hole 35 is connected to the vacuum pump (not shown) formed outside via the tube 36 for suction interpolated in the insert portion 31.

[0045]Therefore, after inserting the insert portion 31 into the abdominal cavity and locating the tip part 32 in the body tissue 30, by making the suction hole 35 into negative pressure with a vacuum pump, the tip part 32 can be made to stick to the body tissue 30, and the metabolic turnover information on the body tissue 30 can be measured correctly.

[0046]Drawing 13 is what equipped the tip part 32 of the insert portion 31 of a probe with the press function, 33 is a window of source container and 34 is a sensor window. The balloon 37 is formed in the side of the tip part 32 in which it is located in the opposite hand of the window of source container 33 and the sensor window 34. This balloon 37 is formed outside via the tube 38 for supplied airs interpolated in the insert portion 31, and is connected to the compressor 40 controlled by the control device 39.

[0047]Therefore, by feeding air on the balloon 37 by the compressor 40, after inserting the insert portion 31 in a lumen and locating the tip part 32 in the body tissue 30, The balloon 37 expands, one luminal wall is pressed, according to the reaction force, the tip part 32 can be pressed against the target part of the body tissue 30, and the metabolic turnover information on the body tissue 30 can be measured correctly.

[0048]Drawing 14 is what equipped the tip part 32 of the insert portion 31 of a probe with the liquid-sending function, 33 is a window of source container and 34 is a sensor window. The liquid-sending channel 41 and the foam connection 42 open for free

passage are formed in the side of the tip part 32 in which it is located in the opposite hand of the window of source container 33 and the sensor window 34. The liquid-sending channel 41 is open for free passage to the reservoir 44 which accommodates a physiological saline via the pump 43.

[0049]Therefore, by feeding the liquid-sending channel 41 for a physiological saline with the pump 43, after inserting the insert portion 31 in a lumen and locating the tip part 32 in the body tissue 30, A physiological saline blows off from the foam connection 42 toward one luminal wall, according to the reaction force, the tip part 32 can be pressed against the target part of the body tissue 30, and the metabolic turnover information on the body tissue 30 can be measured correctly.

[0050]Drawing 15 - drawing 17 show the probe 46 with the flat state part-of-light-sending-and-receiving material 45 to a tip part, and two or more windows of source container 47 and the one sensor window 48 are formed in the flat portion of the part-of-light-sending-and-receiving material 45.

[0051]Said two or more windows of source container 47 are connected to the end of two or more fibers 49 for an exposure interpolated in the probe 46, respectively, and the sensor window 48 is connected to the end of the one fiber 50 for light-receiving similarly interpolated in the probe 46.

[0052]On the other hand, the dichroic mirror 52 is arranged on the optical path of two or more laser diodes 51 as a light source, and the mirror 53 is installed on this reflected light path. It is provided on the reflected light path of this mirror 53, enabling free rotation of the prism 54, and irradiation light can be selectively entered now into the incidence edge of said fiber 49 for an exposure with this prism 54. The other end of said fiber 50 for light-receiving counters the photo detector 55, and is provided.

[0053]Therefore, where it inserted the probe 46 into the abdominal cavity and the part-of-light-sending-and-receiving material 45 is joined to the target part of the body tissue 30, If light is serially emitted from each of two or more laser diodes 51, irradiation light will enter into the incidence edge of the fiber 49 for an exposure selectively via the dichroic mirror 52, the mirror 53, and the prism 54.

[0054]The irradiation light which entered into the fiber 49 for an exposure is irradiated by the body tissue 30 from the window of source container 47 of the part-of-light-sending-and-receiving material 45, and the catoptric light is received by the sensor window 48. And light is received by the photo detector 55 via the fiber 50 for light-receiving.

[0055]In this case, since it has two or more windows of source container 47, by choosing the window of source container 47, the interval of an irradiation part and a light sensing portion can be changed, and the metabolism condition from the shallow portion of a body tissue to a deep portion can be measured in distribution. Since the part-of-light-sending-and-receiving material 45 is flat state, an irradiation part and a light sensing portion can be stuck to the body tissue 30, and efficient information

detection can be performed.
[0056]As shown in drawing 17, three-dimensional information is acquired to a depth direction by making the part-of-light-sending-and-receiving material 45 at the tip of the probe 46 scan on the body tissue 30.
[0057]Drawing 18 and drawing 19 form the spiral tip part 57 in the probe 56, form the window of source container 58 and the sensor window 59 in this tip part, and raise the adhesion of the tip part 57 to a body tissue.
[0058]The wire 60 which consists of shape memory alloys is interpolated in said tip part 57. Although this wire 60 is memorized spirally and is straight at the time of un-energizing, it restores spirally by heating.
[0059]Therefore, a myocardium will be exposed, if penetrate the guide cylinder 62 to the breast wall 61, this guide cylinder 62 is inserted into the abdominal cavity for example, the film (not shown) which leads to the heart 63 is cut and a pericardium is cut open. A myocardium has doubt of myocardial infarction, if there is little range of infarction, can be treated by coronary-bypass operation etc. and can save the myocardium of the circumference of myocardial infarction from the ischemia.
[0060]Looking at a myocardium under the thoracoscope as mentioned above, in order to perform this judgment, by considering said guide cylinder 62 as a guide, the tip part 57 inserts the straight probe 56, energizes and heats on the wire 60 after insertion, makes the tip part 57 spiral, and joins on the tunica muscularis of the heart 63.
[0061]And the metabolic turnover information on the heart 63 can be correctly measured by irradiating with the window of source container 58 and the sensor window 59 toward the heart 63 in the state where it stuck on the tunica muscularis of the heart 63, from the window of source container 58.
[0062]
[Effect of the Invention]If according to this invention at least two or more one side is arranged along the shaft orientations of a probe among an inspection light emitting part or an inspection light light sensing portion and inspection light is emitted one by one from two or more inspection light emitting parts as explained above, Inspection light is penetrated being scattered about and reflecting a body tissue, and is received by the inspection light light sensing portion corresponding to an inspection light emitting part. It is effective in the ability to measure the metabolic turnover information on a body tissue in distribution, and measure the wide range correctly in a short time by repeating this.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The vertical section side view of the tip part of the probe concerning the 1st example of this invention.

[Drawing 2]The timing chart figure of the example.
[Drawing 3]The perspective view showing the arrangement state of the light-emitting part of the example, and a light sensing portion.
[Drawing 4]The metabolic turnover distribution map of the example.
[Drawing 5]The perspective view of the probe concerning the 2nd example of this invention.
[Drawing 6]The perspective view of the probe concerning the 3rd example of this invention.
[Drawing 7]The rough lineblock diagram of the whole metabolic turnover information measuring device.
[Drawing 8]The vertical section side view of the probe of the device.
[Drawing 9]The vertical section side view of BUROBU of the device.
[Drawing 10]The side view of a probe with a sucking function.
[Drawing 11]The sectional view which meets the arrow a-a line of drawing 10,
[Drawing 12]The side view of the condition of use of the probe.
[Drawing 13]The vertical section side view of a probe with a balloon.
[Drawing 14]The vertical section side view of a probe with the jet function which spouts a physiological saline.
[Drawing 15]The rough lineblock diagram of the whole metabolic turnover information measuring device which had flat state part-of-light-sending-and-receiving material in the tip part of a probe.
[Drawing 16]The side view of the condition of use of the device.
[Drawing 17]The perspective view of the condition of use of the device.
[Drawing 18]The perspective view of the condition of use in the probe with which a tip part curves spirally.
[Drawing 19]The sectional view which meets the arrow b-b line of drawing 18.
[Drawing 20]The perspective view showing the general measurement state of a myocardium.
[Description of Notations]
4 -- A probe, 6 -- An optical fiber, 7a-7f -- Transmission-and-reception optical window.
11 -- A light source, 14 -- Detector.